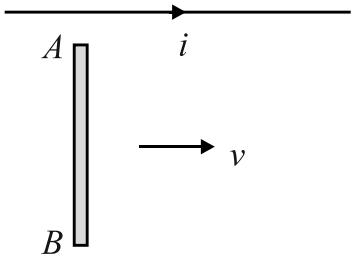
JEE 2023

Electromagnetic Induction

DPP-04

1. The current carrying wire and the rod AB are in the same plane. The rod moves parallel to the wire with a velocity v. Which one of the following statements is true about induced emf in the rod



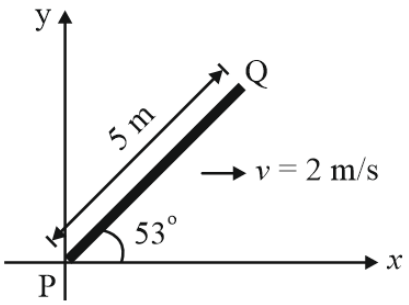
(1) End A will be at lower potential with respect to B

(2) A and B will be at the same potential

(3) There will be no induced e.m.f. in the rod

(4) Potential of A will be higher than that at B

2. A conducting rod PQ of length 5m oriented as shown in figure is moving with velocity $2\hat{\imath}$ m/s without any rotation in a uniform magnetic induction of $(3\hat{\jmath} + 4\hat{k})$T. EMF induced in the rod is



(1) 32 volt (2) 40 volt

(3) 50 volt (4) None

3. A coil having n turns and resistance RΩ is connected with a galvanometer of resistance 4RΩ. This combination is moved in time t seconds from a magnetic field W_1 weber to W_2 weber. The induced current in the circuit is

(1) $-\frac{W_2 - W_1}{5\,Rnt}$ (2) $-\frac{n(W_2 - W_1)}{5\,Rt}$

(3) $-\frac{(W_2 - W_1)}{Rnt}$ (4) $-\frac{n(W_2 - W_1)}{Rt}$

4. A magnetic field of 2×10^{-2} T acts at right angles to a coil of area 100 cm^2 with 50 turns. The average emf induced in the coil is 0.1 V, when it is removed from the field in time t. The value of t is

(1) 0.1 sec (2) 0.01 sec

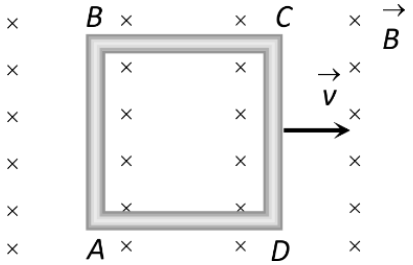
(3) 1 sec (4) 20 sec

5. Two rails of a railway track insulated from each other and the ground are connected to a milli voltmeter. What is the reading of voltmeter, when a train travels with a speed of 180 *km/hr* along the track. Given that the vertical component of earth's magnetic field is $0.2 \times 10^{-4} Wb/m^2$ and the rails are separated by 1 *metre*

(1) 10^{-2} volt (2) 10^{-4} volt

(3) 10^{-3} volt (4) 1 volt

6. A conducting square loop of side L and resistance R moves in its plane with a uniform velocity v perpendicular to one of its sides. A magnetic induction B constant in time and space, pointing perpendicular and into the plane of the loop exists everywhere. The current induced in the loop is



(1) $\frac{Blv}{R}$ clockwise

(2) $\frac{Blv}{R}$ anticlockwise

(3) $\frac{2Blv}{R}$ anticlockwise

(4) Zero

7. A metal rod moves at a constant velocity in a direction perpendicular to its length. A constant uniform magnetic field exists in space in a direction perpendicular to the rod as well as its velocity. Select the correct statement(s) from the following

(1) The entire rod is at the same electric potential

(2) There is an electric field in the rod

(3) The electric potential is highest at the centre of the rod and decreases towards its ends

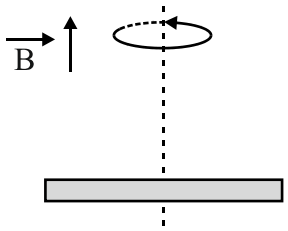
(4) The electric potential is lowest at the centre of the rod and increases towards its ends

8. A uniform magnetic field exists in a region given by $\vec{B} = 3\hat{\imath} + 4\hat{\jmath} + 5\hat{k}$. A rod of length 5m along *y*-axis moves with a constant speed of 1 ms^{-1} along *x*-axis. Then the induced emf in the rod will be

(1) 0 (2) 25 V

(3) 20 V (4) 15 V

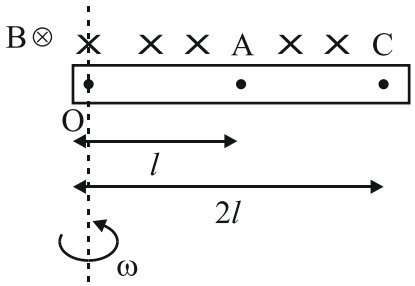
9. A conducting rod of length $2l$ is rotating with constant angular speed *w* about its perpendicular bisector. A uniform magnetic field $\vec{B}$ exists parallel to the axis of rotation. The e.m.f. induced between two ends of the rod is



(1) $B\omega l^2$ (2) $\frac{1}{2}B\omega l^2$

(3) $\frac{1}{8}B\omega l^2$ (4) Zero

10. The potential difference between points A & C is



(1) $\frac{1}{2}B\omega^2 l^2$ (2) $\frac{3}{2}\omega B l^2$

(3) $\frac{5}{2}\omega B l^2$ (4) $B\omega l^2$

Answer Key

1. **(4)**
2. **(1)**
3. **(2)**
4. **(1)**
5. **(3)**
6. **(4)**
7. **(2)**
8. **(2)**
9. **(4)**
10. **(2)**